Experimenters Guide to the WC2050 Modem Board

CONTENTS

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INSTALLATION INSTRUCTIONS
WC2050 MODEM RS232 ADAPTOR KIT

IMPORTANT: These instructions are always supplied accompanied with a reprint of an article from the March/April issue of Time Designs Magazine. The article, entitled "How to Convert a Surplus WC2050 Modem into an RS-232 Serial Interface for your TS1000/1500/2068" was authored by the technical staff of Zebra Systems and is directly applicable to the RS232 adaptor kit, or PC board, supplied herein. BEFORE PROCEDING WITH THE FOLLOWING INSTALLATION INSTRUCTIONS YOU SHOULD READ THE REPRINT.

Also, we only recommend this kit be installed by a hobbyist having some experience with soldering and electronic construction techniques. If you don't have this experience, we suggest that you either find a knowledgable friend to help you, or simply return your kit for a prompt refund.

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1) Your RS232 adaptor kit has been tested by Zebra Systems. If you first read the accompanying Time/Designs article and then follow these simple instructions you should find it easy to install the adaptor board.

2) Before installing the board, examine and test your modem board to make sure it works.

-If your modem board works completely goto step 3.

-If the modem seems to work partially but not completely, it may still be good for this project as long as the digital portion works, since the anaolg section of the modem is not used for simple RS232 communications.

-If the computer does not run at all with the modem board connected, this problem must be resolved before continuing with this project.

3) Once you have a working modem board, proceed:

- The following traces must be cut on the bottom side of the modem board. Find the large 28-pin chip near the incoming computer cable. The number on the chip will be INS8251N or similar. The traces to pins 3,17, and 22 of this chip must be cut,(refer to Figure 5 in the reprint). Pin number one of the chip can be identified by a notch at the front end of the chip. Count the pins one through 14 down across the left side of the chip, and 15 through 28 up across the right side of the chip. Use an Exacto-Knife of similar implement to make the required cuts. Be carefull not to cut yourself.

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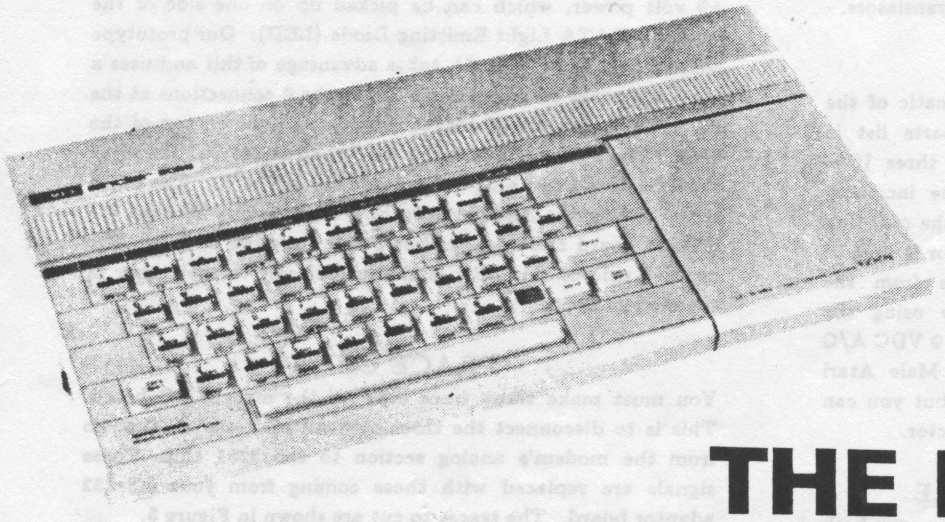
FOR THE T/S 2068 AND ALL OTHER
TIMEX AND SINCLAIR COMPUTERS

Time Designs T.M.

MAGAZINE



THE POWER IS *STILL* WITHIN YOUR REACH

How to Convert a Surplus WC2050 Modem into an RS-232 SERIAL INTERFACE for your TS1000/1500/2068

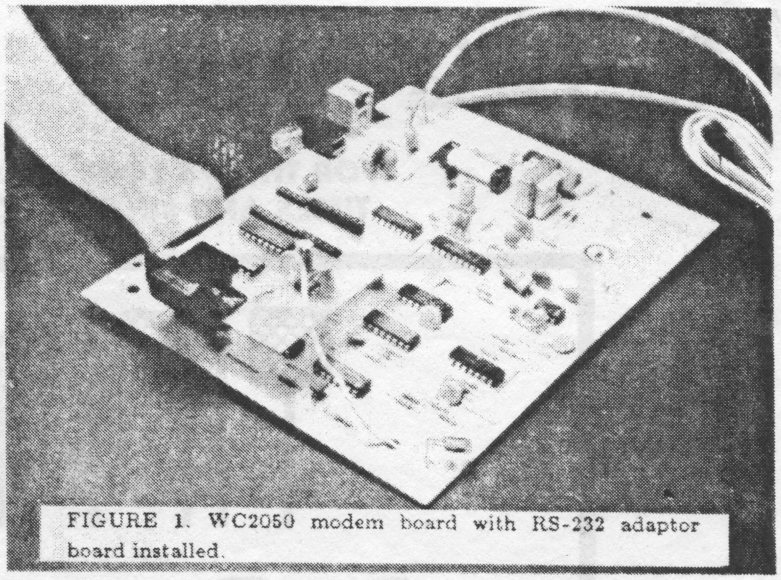


FIGURE 1. WC2050 modem board with RS-232 adaptor board installed.

INTRODUCTION

The purpose of this article is to show you how, with the addition of a few inexpensive components, you can convert a WC2050 modem board into a general purpose RS232 serial interface.

In October of last year, Anchor Automation auctioned off several thousand completely assembled WC2050 Modem boards as electronic surplus. Fortunately for Timex users, these boards were discovered by Timex support companies like Zebra Systems, Clifford Associates, Sunset Electronics, and RMG, and are being resold to Timex users at bargain basement prices.

BLOCK DIAGRAM

Now take a look at Figure 2. It shows a block diagram of the modem board. The address decoding, crystal oscillator, frequency divider and 8251 serial I/O, and power supply portions provide nearly all we need for an RS232 interface. As a complete modem, the input and output serial data available at the points marked A and B, would be connected to the modem's analog circuitry and translated between tone frequencies and voltage levels. For an RS-232 interface we need to redirect these signals to DC voltage level translators.

RS-232 PARTS

Next take a look at Figure 3. It shows a schematic of the recommended RS-232 adaptor circuit. The parts list is contained in Figure 4. Notice that there are only three IC's. A MC1889 Line Receiver is used to buffer the incoming signals; a MC1888 Line Driver is used to buffer the outgoing signals; and an Intersil ICL7662 switching regulator is used to develop the required negative supply voltage from the modem's +9 Volt supply. An alternative to using the switching regulator would be to just use a second 9 VDC A/C adaptor. In our prototype we used a 9-Pin Male Atari Joystick style connector for our RS232 output, but you can directly wire in a cable or another choice of connector.

INSTALLATION PROCEDURE

Before installing the RS-232 adaptor board, be sure you have a working modem board in front of you. It is not important that the modem's analog section be working as long as the digital portion of the board is working. Of course if the entire modem does work, the digital portion will work.

Build up the circuit shown in figure 3. The parts are easy to find except for the Intersil regulator (see below). An optional etched and drilled PC board is available to simplify building the circuit, but any small protocard such as the ones available from radio shack will do fine.

CONSTRUCTION HINTS

The RS-232 adaptor board requires 9 signals from the modem board:

OUTPUT SIGNALS: RTS , TX, DTR
INPUT SIGNALS: RX, CTS, DSR
POWER SIGNALS: GROUND, +5 Volts, +9 Volts

Eight of these signals are available at the pins of the 8251 serial I/O chip. The only signal not present on the chip is the +9 volt power, which can be picked up on one side of the modem's DATA Light Emitting Diode (LED). Our prototype board (shown in Figure 1), takes advantage of this and uses a pin-and-socket arrangement to make the 8 connections at the IC. First a 28-pin IC socket is soldered right on top of the 8251. Then pins are soldered onto the RS-232 PC Board so that the board can plug in, right on top of the IC. The ninth signal required is made by attaching a single wire between the RS-232 board and the +9 Volt power were the LED is. The positive side of this LED is the lead closest to the corner of the modem board.

TRACE CUTS

You must make three trace cuts on the modem PC board. This is to disconnect the three modem input-signals that go from the modem's analog section to the 8251 chip. These signals are replaced with those coming from your RS-232 adaptor board. The traces to cut are shown in Figure 5.

SOFTWARE & TESTING

If you just want to test out your RS-232 by itself you can do a simple wrap around test by temporarily connecting CTS to RTS, and TX to RX. A sample TS2068 software driver for the modem is shown in figure 6. Under this test arangement, whatever you send out will be wrapped around and received back.

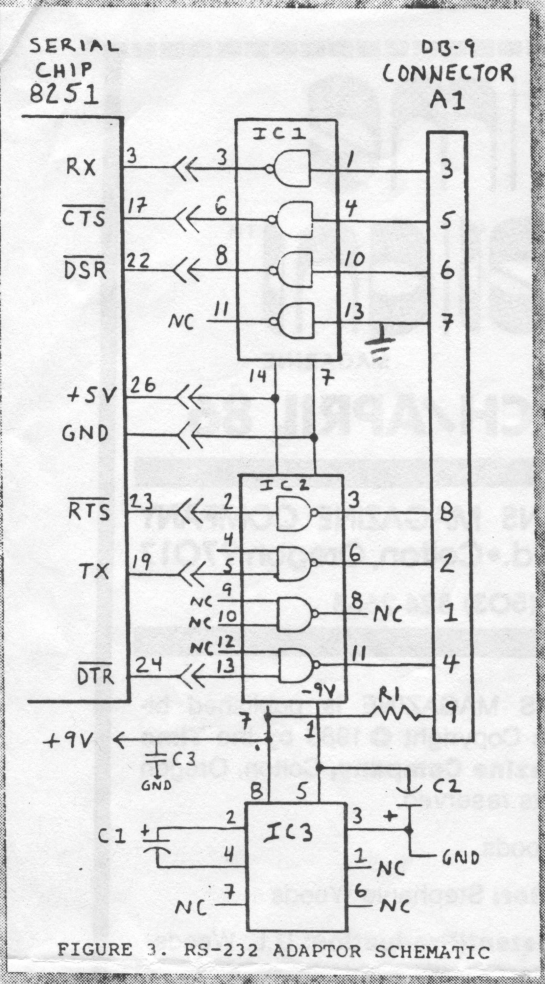


FIGURE 3. RS-232 ADAPTOR SCHEMATIC

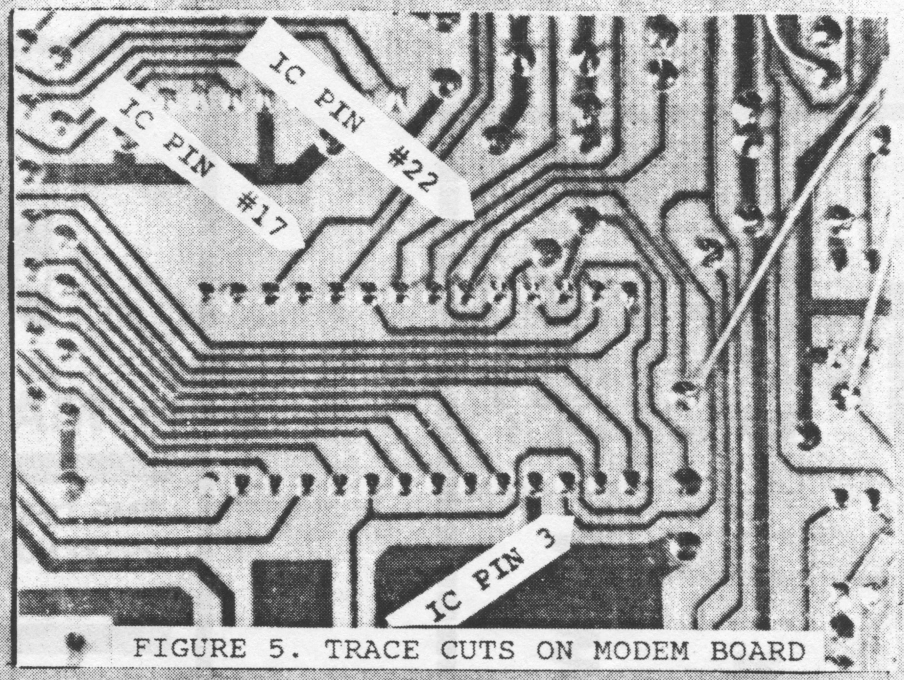


FIGURE 5. TRACE CUTS ON MODEM BOARD

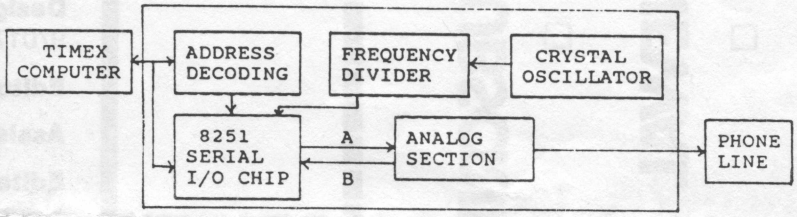


FIGURE 2. MODEM BLOCK DIAGRAM

FIGURE 4. WC2050-TO-RS232 PARTS LIST

IC1	MC1489 QUAD LINE RECEIVER
IC2	MC1488 QUAD LINE DRIVER
J1,J2	WIRE JUMPERS, 0.3 INCH
J3	WIRE JUMPER, 4.5 INCH
A1	CONNECTOR, DB-9 MALE "JOYSTICK TYPE"
A2	DUAL ROW WIRE-WRAP HEADER PINS
R1	RESISTOR, 1K 1/4W
PC89-C	PRINTED CIRCUIT BOARD
C3	0.1UF 25V CER. DISC. (SUPPLY BYPASS)
----------	POWER SECTION - VERSION ONE----------
IC3	INTERSIL ICL7662 POWER CONVERTER IC
C1	10UF 16V ALUM. ELECTROLYTIC (CHARGE PUMP)
C2	10UF 16V ALUM. ELECTROLYTIC (OUTPUT)
----------	POWER SECTION - VERSION TWO ----------
A3	2.5MM OR 3.5MM JACK (NEGATIVE POWER)
X1	AC POWER ADAPTOR

The following items are available from Zebra Systems:

- RS-232 Adaptor Etched & drilled PC board with project instructions, price $5.95.
- Intersil ICL7662 Power Converter IC & Specs.,$5.00
- Complete kit for adaptor including PC Board, all 3 IC's, Capacitors, Connectors and instruction, $19.95

Add $3.00 for Postage & Handling, quantity discounts are available.

FIGURE 6. Sample TS2068 BASIC driver for wrap-around test at 1200 BAUD. Change 78 in line 14 to 79 for 300 baud.

```
  10 OUT 119,0: REM send Zero to
                   clear UART chip
  11 OUT 119,0
  12 OUT 119,0
  13 OUT 119,64: REM UART reset
  14 OUT 119,78: REM 1200b,8 bit
                    NO parity
  15 OUT 119,55: REM Enable Xmit
                    and Receive
  20 REM Each byte sent OUT 115
     will arive on the Transmit
     line of the RS-232 port.
  25 REM Example:
  30 PRINT "This is a test."
  40 LPRINT "This is a test."
  50 LET a$="This is a test.": G
O SUB 1000
  60 PRINT "End of TEST."
  70 LPRINT "End of TEST."
  80 LET a$="End of TEST.": GO S
UB 1000
  90 STOP
1000 LET i=LEN a$: IF i=0 THEN G
O TO 1050
1010 FOR x=1 TO i
1020 OUT 115,CODE a$(x): PAUSE 4
1030 PRINT CHR$ IN 115;
1040 NEXT x
1050 RETURN
```

**** EXPERIMENTERS QUIDE TO THE WC2050 MODEM BOARD ****

WC2050 MODEM BOARD ADDRESS DECODING

The two 74LS138's are wired onto the computer bus as shown on the WC2050 schematic and as summarized in the following logic tables. The chip select at pin 12 of U3 goes low for two address, 73H and 77H because A2 is not decoded. A2 is fed directly to pin 12 of the 8251 serial chip and thus port 73H is used for transmit and receive data, and 77H for control and status information.

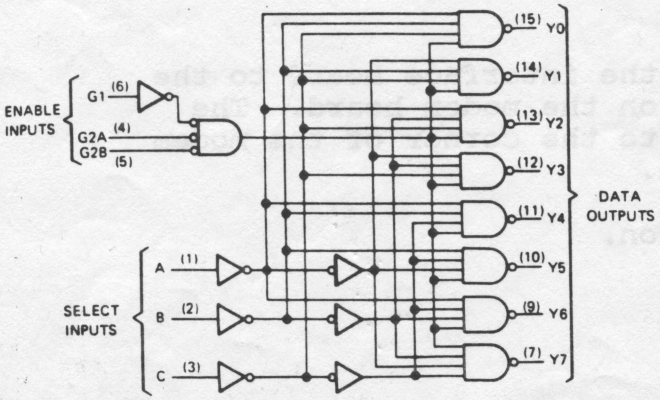
Anyone familiar with simple logic decoders can see that the address of the modem can be changed without adding any chips, but by simply rewiring the connection to and from U1 and U3.

74LS138 IC U1						
COMPUTER BUS SIGNAL	A6	A7	A3	A0	A1	
74LS138 IC PIN	6	5	3	2	1	12
74LS138 SIGNAL	G1	G2B	C	B	A	Y3
STATE FOR Y3=LOW	H	L	L	H	H	L

74LS138 IC U3						
COMPUTER BUS SIGNAL	+5	U1-Y3	GND	A5	A4	CS
74LS138 IC PIN	6	5	3	2	1	12
74LS138 SIGNAL	G1	G2B	C	B	A	Y3
STATE FOR Y3=LOW	H	L	L	H	H	L

WC2050 STANDARD ADDRESS PORTS 77H & 73H							
A7	A6	A5	A4	A3	A2	A1	A0
L	H	H	H	L	X	H	H

'LS138, 'S138

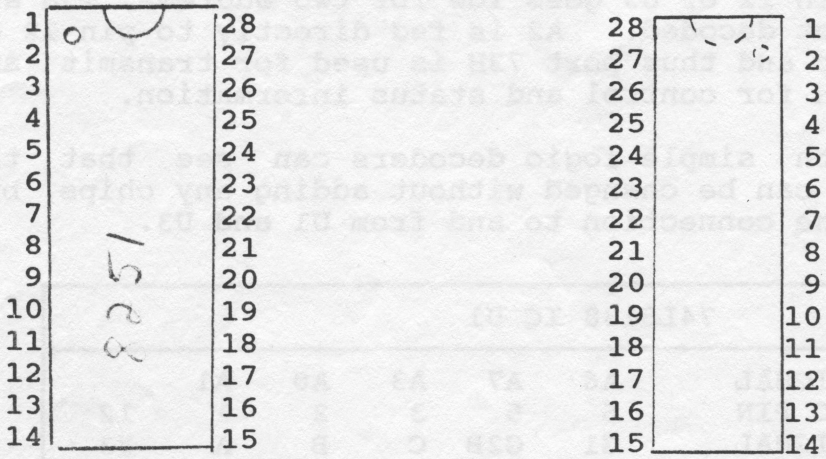


'LS138, 'S138
FUNCTION TABLE

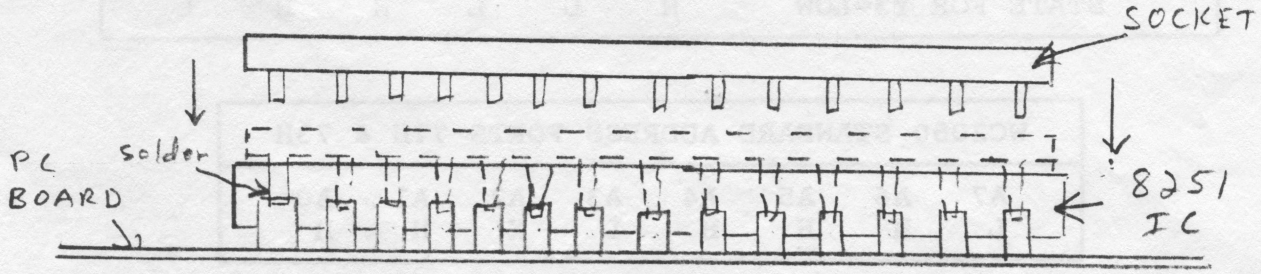
INPUTS					OUTPUTS							
ENABLE		SELECT										
G1	G2*	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X	H	X	X	X	H	H	H	H	H	H	H	H
L	X	X	X	X	H	H	H	H	H	H	H	H
H	L	L	L	L	L	H	H	H	H	H	H	H
H	L	L	L	H	H	L	H	H	H	H	H	H
H	L	L	H	L	H	H	L	H	H	H	H	H
H	L	L	H	H	H	H	H	L	H	H	H	H
H	L	H	L	L	H	H	H	H	L	H	H	H
H	L	H	L	H	H	H	H	H	H	L	H	H
H	L	H	H	L	H	H	H	H	H	H	L	H
H	L	H	H	H	H	H	H	H	H	H	H	L

*G2 = G2A + G2B

H = high level, L = low level, X = irrelevant



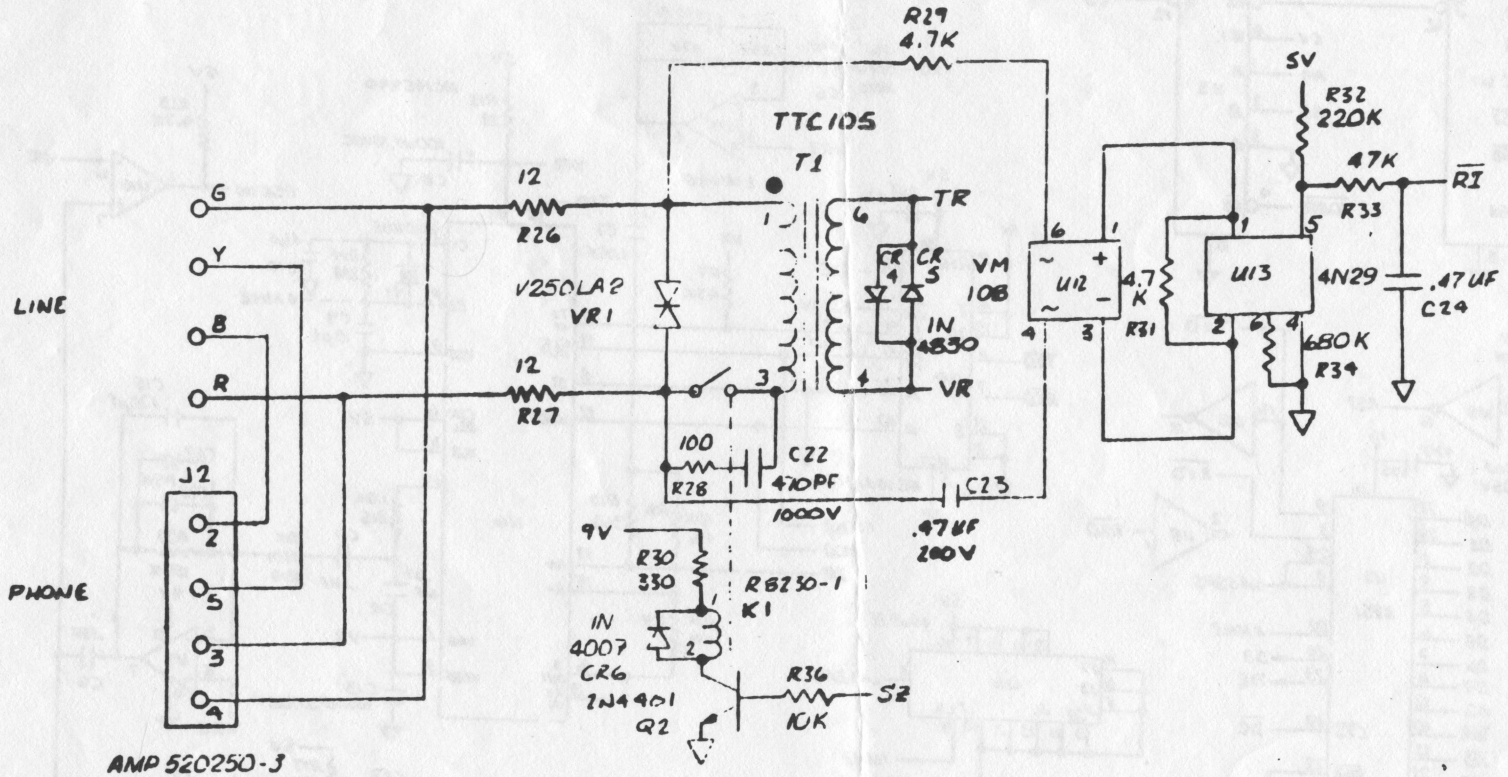
3) Install the 28 pin socket on top of the 28 pin IC, piggy-back style. Position the socket carefully so that the pins of the socket line up directly with the pins of the 28 pin chip. Solder each pin of the socket to it corresponding chip pin. Make sure there are no shorts between adjacent pins.



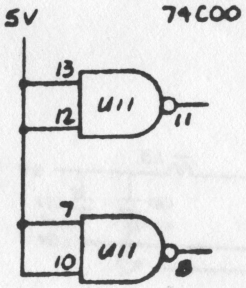
4) Plug the assembled RS232 interface board into the socket you have just installed. The orientation of the board should be as shown in Figure 1 of the reprint.

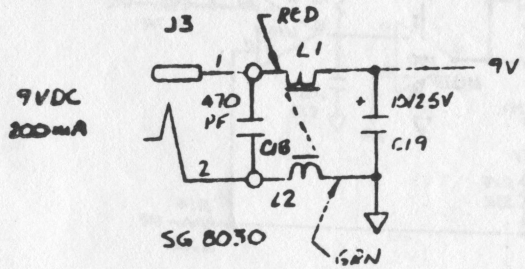
5) Connect the one loose wire on the interface board to the positive side of the DATA L.E.D. on the modem board. The positive side is the one closest to the corner of the modem board. Solder this wire in place.

6) This completes your installation.



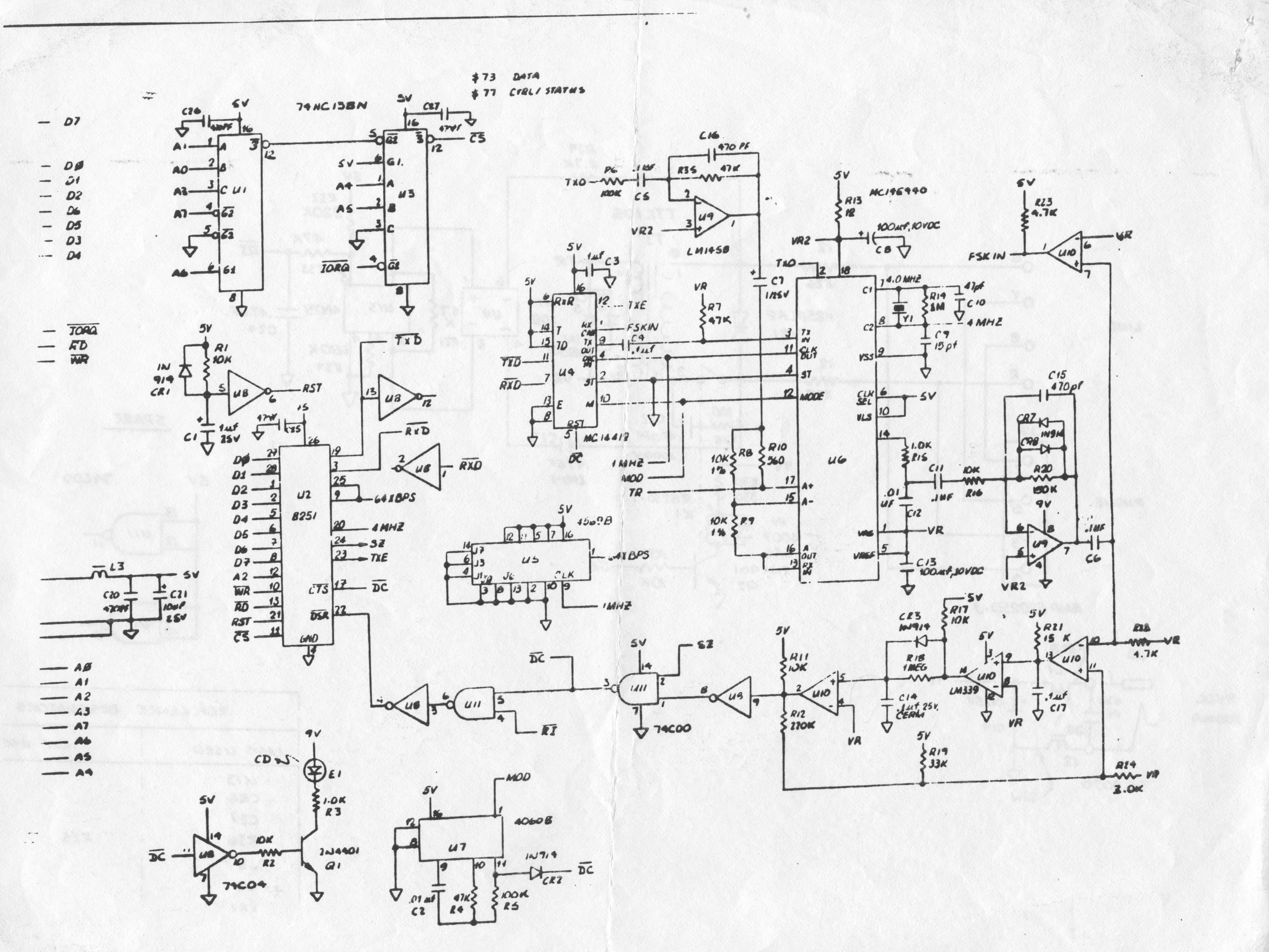
SPARE





REFERENCE DESIGNATORS	
LAST USED	NOT USE
U13	
CR6	
C27	
R36	R25
J3	
L3	
VR1	

J2


$73 DATA
$77 CTRL/STATUS
74HC138N
MC196940
LM1458
LM339
8251
MC14412
4060B
4520B
74C00
74C04
2N4401
U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
U11
D7
D0
D1
D2
D6
D5
D3
D4
A0
A1
A2
A3
A7
A6
A5
A4
TXD
RXD
TXE
FSKIN
1MHZ
4MHZ
64KBPS
MOD
TR
RST
DC
RI
SZ
VR
VR2
5V
9V